Hand-on laboratory exam

1. Objectives

- To evaluate each student's ability to use a power supply.
- To evaluate each student's ability to use a function generator.
- To evaluate each student's ability to use a DMM to measure DC values of voltage and current.
- To evaluate each student's ability to use an oscilloscope to measure signal characteristics.

2. Reference

This is a hand-on exam. You can review materials from the previous laboratories if necessary.

3. Circuits

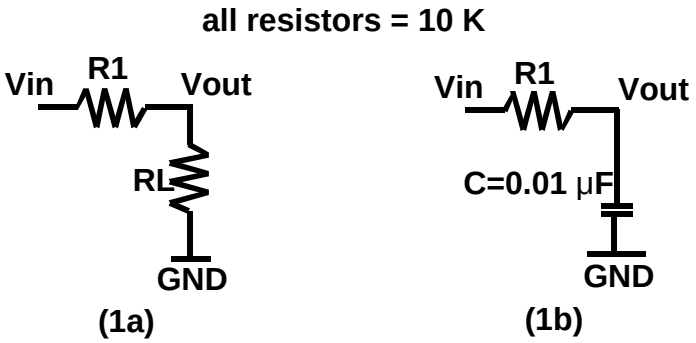

Figure 1. Circuits for hand-on exam.

4. Components and specifications

The components (R and C) to be used for the above circuits are already in the lab kit.

5. Discussion: exam format and grading

a. The exam is administered by the TA to **each** student (NOT a group, but an individual student).

b. The exam is strictly hand-on and oral. No written materials permitted.

c. Each exam is limited to a maximum 10 minutes per student but should easily be completed in 5 minutes.

d. The exams will be carried out in the lab sections during the 10th week of the quarter, during the regular lab time. All exams must be completed no later than the last day of class in the quarter (check UW Time Schedule to find out).

e. The TA will select one of the two exam options below and asks a student **all** the questions in that option. Each option has two parts: DC measurements and AC measurements.

f. The score for each question is given below. The maximum total score is 50, half of the score for a regular laboratory report.

6. Pre-lab

Each student must build the two circuits in figure 1 **before** coming to the exam.

7. Experimental procedures

The TA will select one option below to ask a student. For each option, **all** questions in both Parts 1 and 2 will be asked.

7.1 Instruments needed for this experiment

The instruments needed for this experiment are: a power supply, a function generator, a multimeter, and an oscilloscope.

7.2 Exam option 1

7.2.1 Part 1: DC measurements (20 points)

Use the circuit in figure 1a.

a. Connect the input to a power supply and set the power supply at a value to be decided by the TA (e.g. 5V, or 10V or 12V or any other). Correct connection and setting: 5 points.

b. Use the DMM, measure the voltage at the output. Correct measurement: 5 points.

c. Use the DMM, measure the current through the resistor RL. Do this measurement directly (i.e. you **cannot** measure voltage and convert it to current). Correct connection of the DMM and measurement: 10 points.

7.2.2 Part 2: AC measurements (30 points)

Use the circuit in figure 1b.

a. Connect the input to a function generator and set the generator to a square wave signal. The amplitude and frequency of this signal will be decided by the TA at the exam. Correct connection and settings: 5 points.

b. Use two channels of the oscilloscope to display the input and output signals to get at least two periods on the screen. Correct connection and proper scope displays of two waveforms: 10 points.

c. Get a hardcopy of the waveforms of both channels on the same page using the printer. Correct print: 5 points.

d. Use the scope measurement tools to measure the amplitude of the output signal on the display. Correct measurement: 5 points.

e. Adjust the displays so that one period will be displayed for both signals on the screen. Use the scope measurement tools to measure the time interval between these two points: one where the output amplitude is maximum and one where the output amplitude is half of the maximum. Correct measurement: 5 points.

End of exam for this option.

Good luck in future laboratories!

7.3 Exam option 2

7.3.1 Part 1: DC measurements (20 points)

Use the circuit in figure 1a.

a. Connect the input to a power supply and set the power supply at a value to be decided by the TA (e.g. 5V, or 10V or 12V or any other). Correct connection and setting: 5 points.

b. Use the DMM, measure the voltage at the output. Correct measurement: 5 points.

c. Use the DMM, measure the current through the resistor RL. Do this measurement directly (i.e. you **cannot** measure voltage and convert it to current). Correct connection of the DMM and measurement: 10 points.

7.3.2 Part 2: AC measurements (30 points)

Use the circuit in figure 1b.

a. Connect the input to a function generator and set the generator to a sine or cosine signal. The amplitude and frequency of this signal will be decided by the TA at the exam. Correct connection and settings: 5 points.

b. Use two channels of the oscilloscope to display the input and output signals to get at least two periods on the screen. Correct connection and proper scope displays of two waveforms: 10 points.

c. Get a hardcopy of the waveforms of both channels on the same page using the printer. Correct print: 5 points.

d. Use the scope measurement tools to measure the amplitude of the output signal on the display. Correct measurement: 5 points.

e. Adjust the displays so that one period will be displayed for both signals on the screen. Use the scope measurement tools to measure the time interval between these two points: one where the output amplitude is maximum and one where the output amplitude is half of the maximum. Correct measurement: 5 points.

End of exam for this option.

Good luck in future laboratories!